# memorandum

## Environment and Resources Division

**Date** 8/23/2013

**To** Todd Doley, US EPA/OW

**From** Emmy Giovanni, Dan Basoli, Matt Ranson

**Subject** Literature Review of the Potential for SW Management Control Cost Pass-Through in Residential Development

# 1 Introduction

[redacted] However, it is unclear whether and how increased development costs, when they occur, will manifest in market prices to the eventual consumer or the initial land owner. Developers may pass costs forward to the final consumer, reduce the price paid for land (effectively passing the costs back to the initial land owner), or absorb the cost resulting in lower developer profits (or some combination of these possibilities).

Additionally, best management practices (BMPs) [redacted] require periodic maintenance for high-level functionality over time. The impacts of these recurring O&M costs on market prices for developed properties is also uncertain. This is due primarily to two factors: first, there are myriad approaches that may be utilized to fund these activities; and second, increased maintenance costs associated with green stormwater BMPs may be offset by reductions in what would otherwise be the maintenance costs associated with more traditional "gray" stormwater management infrastructure. This uncertainty is compounded by the fact that many BMPs offer an amenity effect that may also have a positive impact on home values.

The purpose of this memorandum is to explore the literature regarding these questions/issues – that is, who ultimately pays for the incremental increases in up-front development costs [redacted] (i.e., capital costs), who ultimately pays for recurring maintenance costs associated with BMPs [redacted], and how do both types of costs effect land prices, home values, and developer profits.

There is relatively little literature examining these questions specifically for the kinds of stormwater management practices [redacted]. But, literature describing the rate and direction of cost pass-through for comparable development expenses may provide some insight that can inform the regulatory impact analysis. This memo provides a summary of literature related to market effects associated with changes in construction costs, local land-use regulations, and development impact fees. It also briefly discusses the potential effect of developers' and consumers' perception/internalization of future O&M requirements on property values.

# 2 Summary of Findings

There are several important implications of this literature review, including:

# 3 Impact of Changes in Up-Front Development Costs

As noted by U.S. EPA (2009),[1] the extent of cost pass-through of increased construction costs depends largely on the elasticities of supply and demand in the particular market in which the development occurs.

> Many factors contribute to the relationship between supply and demand elasticities and overall market conditions in a given market and at a given point in time. These factors include general economic factors – for example, monetary and credit conditions, condition of the overall economy, etc. – and factors that are more local in character – for example, regional economic strength; extent to which a particular market has seen a substantial recent increase in supply in a particular real estate segment, which has exceeded the underlying strength in demand, etc. (p. 3-6).

The impact of increased construction costs is dictated by local market conditions. As noted by U.S. EPA (2009), in areas where there is greater weakness in prices and sales volume, construction cost increases are less likely to be passed through to home purchasers. Instead, they will be absorbed by owners of developed land, project developers, and builders. **Glaeser and Gyourko (2002)** show that in some areas of the country, housing costs are actually below the cost of construction, while in other areas, the price of homes is much higher than the cost of construction; in most areas, the house prices are approximately the

[1] U.S. EPA (2009) made various assumptions about cost-pass through of pollution control measures implemented during construction and development. In the analysis of single-family housing affordability effects, EPA assumed that compliance costs would be fully passed through to consumers in increased housing prices. However, in the analysis of firm and industry-level impacts, EPA assumed partial and no cost-pass through of these costs to the final home purchaser.

same as construction costs. The authors attribute very high price-to-cost ratios in certain areas to strict zoning codes, which drive a wedge between prices and building costs.

Similarly, **Davis and Heathcote (2006)** found that in regions where house prices are relatively high and connected to high land values (versus construction costs), house prices are also more volatile. The authors point out that in areas where land is cheap, house prices are largely pinned down by construction costs. In contrast, **Shiller (2007)** found construction costs do not track well with home prices, as home prices increased dramatically from 1996 to 2006 with no concurrent increase in construction costs.

## 3.1 Zoning Regulations

As noted by **Ihlanfeldt (2007)**, land-use regulations can increase construction costs either directly (e.g., by increasing development fees or requiring exactions) or indirectly via compliance costs paid to engineers, surveyors, and attorneys to satisfy specific rules regulations. Local regulations that restrict new developments or otherwise increase the costs of residential development may increase housing prices locally if developers can pass the associated costs on to homebuyers. There is extensive literature exploring the extent to which regulations limit new construction or increase the prices of newly constructed houses.

There are a wide variety of potential responses by developers and homebuyers to increased construction costs. For example, builders may shift up-market in response to these increased costs, meaning that they increase the supply of larger houses in comparison to smaller houses. Additionally, regulation-induced increases in construction costs may be shifted backward and reduce the value of undeveloped residential land. Ihlanfeldt (2007) noted that regulations may reduce housing supply by increasing construction costs, but may also increase demand through an amenity effect.

Ihlanfeldt (2007) tested these various hypotheses using data from sales transactions in 25 Florida counties with varying land use restrictions. The results of the analysis show that greater regulation restrictiveness increases the price of homes, but that the effect is smaller in magnitude within markets with a larger number of jurisdictions. The price increase associated with restrictiveness is primarily attributable to increased construction costs rather than amenity effects or reduced supply of variable land. This conclusion is supported by a concurrent reduction in the cost of vacant land. Finally, greater restrictiveness increases interior space and lot sizes of newly constructed homes. This is consistent with the assumption that developers can more easily shift higher regulatory costs forward to the homebuyer if the house is larger.

Ihlanfeldt's (2007) results suggest that the impact of construction costs on home affordability will depend on the number of competing jurisdictions within the local housing market. When the choices are relatively limited, the homebuyer will bear more of the costs. However, when the market has more choices available for homebuyers, a larger share of the increased costs will be shifted back toward developers and landowners.

Other literature demonstrates mixed effects. For example, **Chressanthis (1986**; as cited in Quigley and Rosenthal, 2003**)** assessed the impact of stringent building codes in Indiana, and found that they did not significantly affect home prices. However, **Cho (1991**; as cited in Quigley and Rosenthal, 2003**)** found that restrictiveness (zoning, use designations, and zoning and use designations in adjacent areas) significantly increased home prices both within the district and in nearby jurisdictions. Additional studies include:

- **Mayer and Somerville (2000)** assessed the impacts of approval delays, growth management techniques, and development fees in 44 MSAs. They found that highly regulated areas had supply price elasticity more than 20 percent lower than cities with less regulation.

- **Pollakowski and Wachter (1990)** examined the impacts of land-use constraints on house prices in Montgomery County, Maryland. Their results showed that land-use regulations increased housing and developed land prices both within a locality and across neighboring localities. Additionally, the effects of zoning and growth management controls together exceed the effects of either measure individually. The authors found that, since land-use restrictions also raise prices in adjacent areas, the higher prices are attributable to supply restrictions rather than increased demand for housing due to an amenity effect.
- **Quigley and Raphael (2004)** examined the impacts of regulations on housing prices in California using measures of housing prices from Census data and city-level data on land use regulations and growth controls. Their results show that both rental and owner-occupied housing is significantly more expensive in more strictly regulated cities, and that price elasticity of supply is lower in these cities.
- **Quigley and Rosenthal (2005)** observed that regulations that increase the costs of housing construction or limit expansion of residential developments can be designed to exclude disadvantaged communities. However, reducing the supply of affordable housing can also remove price competition which might lower the price of existing houses.

## 3.2 Impact Fees

Impact fees are one-time levies that are assessed on property developers to support public infrastructure needed to serve new developments. These fees directly increase the costs of residential development and as such, the degree of cost pass-through associated with impact fees may lend insight into the potential for cost pass-through of costs [redacted].[2] As noted by **Skidmore and Peddle (1998)**, to the extent that impact fees represent an increase in the cost of building a home, they would result in a negative impact on home construction (potentially decreasing the amount of homes built and/or increasing the prices of homes). However, impact fees are also associated with improved amenities in the local areas, and as such may increase the development value of the land. Theoretically, it is unclear whether impact fees increase home prices, and, if so, whether these increases are attributable to cost pass-through on the supply side, or increased demand for the amenities afforded through impact fees. There is an extensive body of literature exploring the effects of impact fees.

**Evans-Cowley and Lawhon (2003)** conducted a literature review of the impacts of development impact fees to examine whether the homebuyer ultimately absorbs the costs of the fee, or the developer bears the additional burden. They found that impact fees tend to contribute to housing price inflation in communities where there are no reasonable housing substitutes, and that in these areas the additional costs are capitalized in the price of the home and the land.

**Burge and Ihlanfeldt (2006a)** used panel data to examine the effects of impact fees on single-family home construction. They tested the assertion that impact fees discriminate against construction of smaller homes since the costs are easier to pass forward to higher income buyers, ultimately leading to lower homeownership rates among disadvantaged communities. The authors found that non-water/sewer fees (i.e., fees usually otherwise funded by property taxes) actually increase the number of homes of all sizes in inner suburban areas and medium- and large-sized houses in outer suburban areas. **Burge and Ihlanfeldt (2006b)** found similar results for multifamily housing, with impact fees earmarked for non-

[2] Impact fees are not directly comparable to pollution control costs, since they may increase the demand for houses (especially existing houses) by decreasing future property tax expenses. The authors found that impact fees may also reduce approval costs and relax the implicit limits on the percentage of permits that receive local government approval.

water/sewer fees increasing the stock of multifamily housing construction within inner suburban areas. Water and sewer impact fees, however, were found to reduce construction throughout metropolitan areas.

Other studies evaluating the effects of impact fees include:

- **Chressanthis (1986**; as cited in Skidmore and Peddle, 1998**)** found that impact fees increase land prices by more than the value of the impact fee.
- **Delaney and Smith (1989a and 1989b**; as cited in Shaughnessy 2003**)** evaluated the price effects of impact fees in Florida, and found that after impact fees were adopted, prices for new homes were higher than the prices of existing homes by an amount equal to about twice the impact fee. This results indicate that the impact fee is shifted forward to the buyers of new homes in the affected community. However, Shaughnessy (2003) points out that since the authors included a land price in the regression, they were not able to account for any shifting of costs backward to landowners.
- **Dresch and Sheffrin (1997)** compared the effects of large (typically in the range of $20,000 to $30,000 per dwelling) impact fees on two communities in Contra Costa County, California; one community (eastern County) has smaller houses further away from employment centers than the other (western County). They found that the effects of the impact fee were much smaller in the eastern County, with a price increase of $0.23 for existing homes and $0.25 for new homes for each dollar of impact fee. In the western County, there was a price increase of $1.88 in new homes for each dollar of impact fee. The authors noted that in the eastern County, the housing market was significantly more distressed, so developers were more willing to absorb the fees in order to sell the properties.
- **Huffman et al. (1988)** examined the distribution of impact fee burdens, and found that neither developers nor landowners bear the burden of paying for impact fees. Instead the consumers, including homebuyers, renters, or nonresidential tenants, pay the major share of impact fees in the long term.
- Mayer and Somerville (2000) assessed the impacts of approval delays, growth management techniques, and development fees in 44 MSAs. They found that purely financial regulations (such as development fees) have much smaller effects on new construction activity than regulations that induce delays or lengthen the construction process.
- **Shaughnessy (2003)** evaluated the effects of development impact fees on housing and land markets in new developments in Florida. Modeling results showed that an additional dollar of impact fees increased the prices of new and existing homes by $1.60. This is consistent with expected future property tax savings resulting from the additional revenues generated by the fee.
- **Singell and Lillydahl (1990)** assessed impact fees in Loveland, Colorado using data before and after the imposition of impact fees. They found that imposition of an impact fee (which increased fees by $1,182) increased the price of a new house by approximately $3,800. The authors note that this relatively large impact could be explained by a variety of factors, but that any explanation inherently suggests that the costs are borne by the buyers rather than the developers. They also found that the price of existing houses increased by $7,000 as a result of the impact fee, suggesting that owners of existing houses experience capital gains as a result of the fees imposed on new development.
- **Skaburskis and Qadeer (1992)** used data from Toronto suburban municipalities during 1977 to 1986 to examine the impact of development impact fees. They found that the fees directly increased lot prices by 1.2 times the size of the fee. The impact of the fee was related to the rate of growth. The faster the rate of growth in the area, the smaller the impact of the fee. Their model results also suggested that increase in future expected construction costs (in the form of material

prices, wages, development approval processes, growth controls, or impact fees) resulted in decreased lot prices.

- **Skidmore and Peddle (1998)** evaluated the effect of impact fees on residential development in municipalities in DuPage County Illinois (between 1977 and 1992) and found that impact fees reduce rates of residential development by more than 25%.

# 4 Impact of Changes in Development O&M Requirements

If [redacted] ongoing maintenance costs are borne by homeowners and have a significant negative impact on homebuyers' willingness to pay for a property, then decreases in property values may result from pollution control measures, limiting developers' abilities to pass their costs on to homebuyers. On the other hand, if pollution control measures such as increased green space, trees, or retention ponds offer amenity values, then there may be an increase in home values as homebuyers increase their willingness to pay in response to amenities.[3]

These tradeoffs, which are partly subjective value judgments on the part of the eventual property owner, make it challenging to characterize how property values may be affected by BMP maintenance requirements. The myriad possible ways that these costs may or may not manifest to the property owner further confounds the issue. For example,

> Homeowners' associations, private businesses, or individual property owners are often supposed to handle the upkeep, inspections, and maintenance of the BMPs on their properties. This is the case for the retention ponds at many housing subdivisions across the country. After the developer leaves, it's up to the homeowners' association to pay for the pond's upkeep (Rafter 2000).

Under this approach, the property owner is not responsible for the maintenance itself, but may effectively pay for it through increased HOA fees, which in turn may affect the price the property owner will pay for the home.

> In other instances, cities or municipalities and their public works departments handle the maintenance. This usually occurs with filters, proprietary devices, and retention ponds on public property. There are times, too, when municipalities may take over the maintenance duties on some BMPs located in housing subdivisions and other private lands if municipal officials recognize that the homeowners' association or business responsible for them is doing a poor job (Rafter 2000).

**Langbein and Spotswood-Bright (2004)** evaluated the impacts of residential community association (RCAs) on property values. The authors found that, at average home prices and with management variables held constant, a $2.50 increase in monthly homeowners' association fees resulted in a $277 decrease in the sales value of the home. This indicates that increased HOA fees in response to maintenance responsibilities may depress home values.

Similarly, when cities or municipalities assume responsibility for BMP maintenance, property owners may be affected by additional property taxes, water/wastewater utility fees, specific fees associated with

[3] An extensive body of literature has documented the positive impact of features such as increased green space and water features on home values. The presence of these features may increase home values to a level where the developers' additional costs of providing them are offset. These impacts are documented in a separate analysis conducted as part of the benefits analysis for the post-construction rule.

stormwater, or other costs. **Oates (1969)** used cross-sectional data to evaluate the impacts of property taxes (which also increase the annual cost of home ownership). He found that local property taxes have a significant negative effects on property values with there is no accompanying increase in the output of local public services. However, when public services (in this case, school improvements), the depressive effect of higher taxes on property values is partially or completely offset.

**U.S. EPA (2013)** examined the O&M practices of 22 GI projects that were funded under the American Recovery and Reinvestment Act of 2009, including rain gardens, pervious pavement, constructed wetlands, rain barrels, bioswales, and green roofs. Responsibility for maintenance of these features varies widely; in 23% of the projects, private organizations, entities, or homeowners are responsible for O&M. Others are maintained municipally (36%), with funding provided by stormwater utility fees or municipal general accounts, or jointly between private and public sectors (36%). Where property owner involvement is required for proper maintenance, legal agreements between property owners, residents, or contractors provide a strong incentive to ensure maintenance. Five of the projects reviewed by U.S. EPA (2013) reported O&M cost estimates, as well as the funding sources. Table 3-1 summarizes these projects.

**Table 3-1: Average Annual Cost of Green Infrastructure O&M (U.S. EPA 2013)**

| State | Project Sponsor | BMPs | O&M Funding Source |
|---|---|---|---|
| ME | Long Creed Watershed Management District (LCWMD) | Bioretention/ bioswales, vegetative plantings (including trees) | Participating landowner fee assessment by LCWMD |
| MD | Edmonston | Wetlands, riparian restoration, pervious pavement, vegetative plantings (including trees) | Facility maintenance operating budget |
| KS | Lenexa | Bioretention/ bioswales, pervious pavement, vegetative plantings (including trees) | Stormwater utility fee |
| CA | American Rivers – Yuba Watershed | Bioretention/ bioswales, other unspecified BMPs | Included in existing county maintenance budget |
| WA | Olympia | Bioretention/ bioswales, wetlands, pervious pavement, other unspecified BMPs | Stormwater utility fees |

Literature exploring the impact of ongoing maintenance costs on home prices is very limited. The majority of studies examining pollution control practices on private property document policies that use incentives (financial or educational) to encourage practices on the part of property owners. These studies include:

- **U.S. EPA (2012)** provides an overview of LID costs compared with traditional grey infrastructure. As noted in the fact sheet, LID practices typically require ongoing maintenance but are more cost effective in the long run. U.S. EPA (2012) described an example in Portland, Oregon, where the city hires landscaping companies to regularly check and maintain LID features. Portland also encourages voluntary participation in community members through a program known as Green Street Stewards. Additionally, some municipalities rely on property owners or homeowners' associations to maintain features on private land – in these cases, U.S. EPA (2012) notes that clear ownership and responsibility should be documented through formalized agreements.
- **American Rivers (2013)** examined barriers to effective maintenance of GI projects in the Chesapeake Bay region and identified strategies for overcoming them. Barriers include financing, lack of public awareness/acceptance, limited technical training availability, and minimal or ineffective enforcement and inspection. Methods for overcoming these barriers in the Chesapeake Bay watershed may include dedicated funding sources, volunteer programs and homeowner

incentives to encourage community engagement, establishment of baseline GI maintenance standards and increased training within communities, and dedicated inspection and enforcement separate from grey (traditional) infrastructure. All of the barriers and methods identified by American Rivers (2013) assume that the burden of ongoing maintenance falls to local governments; as such, homeowner participation is voluntary.

- **Rafter (2000)** described the BMP maintenance approach taken by the Lake County Stormwater Management Commission in Illinois. There, the commission approves only those projects that spell out exactly BMP maintenance responsibility and funding source. For example, for one detention pond project, the commission worked with the local village to establish schedules for mowing, re-planting, and herbicide application (to be paid for and conducted by the village), and the agreement included inspection and documentation provisions.
- **Tian (2011)** evaluated barriers to GI and LID implementation, and noted that in many cases, GI fails on private property due to the decentralized nature. In some cases, municipalities provide subsidies to homeowners to offset the additional costs of maintenance. However, these programs are uncommon and often cross-jurisdictional distribution make them less effective.
- **Ruppert (2008)** reviews regulations governing stormwater management in new developments in Florida and the role of homeowners' associations in ongoing maintenance. The author notes that structural stormwater infrastructure is more easily managed by homeowners' associations that own the infrastructure and the common areas, whereas more decentralized LID structures are more complicated for these associations to manage practically and legally since they are spread out across private properties.
- **Bowman and Thompson (2009)** evaluated barriers to implementation of alternative development techniques such as conservation subdivisions in the Midwest. The authors note that in areas where LID or conservation-focused development have occurred, the formation of neighborhood associations or organizations to manage conservation features can be costly. They also found that developers tend to perceive that consumers are not willing to pay for additional open spaces, but that consumers state that they would be willing to pay for these features. The authors conclude that policies implemented at the local level and increased communications about resident demands for these features could encourage developers to adopt more conservation-focused designs since they may be able to pass costs on through improved amenity values.
- **Civic Federation (2007)** reviewed GI projects in several metropolitan areas, and found that in many cases, ongoing maintenance on private property was a crucial component of success. However, ensuring the existence and proper maintenance of GI features on private property is difficult due to the decentralized nature of the projects. Possible strategies for overcoming this barrier, as identified by Civic Federation (2007) include fines for property owners who fail to maintain features or public education and outreach to strengthen voluntary participation.

# 5 Sources


American Rivers. 2013. Staying Green: Strategies to Improve Operations and Maintenance of Green Infrastructure in the Chesapeake Bay Watershed.

Bowman, T. and J. Thompson. 2009. Barriers to Implementation of Low-Impact and Conservation Subdivision Design: Developer Perceptions and Resident Demand. Landscape and Urban Planning 92: 96-105.

Burge, G. and K. Ihlanfeldt. 2006a. Impact Fees and Single-Family Home Construction. Journal of Urban Economics 60: 284-306.

Burge, G. and K. Ihlanfeldt. 2006b. The Effect of Impact Fees on Multifamily housing construction. Journal of Regional Science 46: 5-23.

Civic Federation. 2007. Managing Urban Stormwater with Green Infrastructure: Case Studies of Five U.S. Local Governments. Prepared for The Center for Neighborhood Technology.

Davis, M.A. and J. Heathcote. 2006. The Price and Quantity of Residential Land in the United States.

Dresch, M. and S.M. Sheffrin. 1997. Who Pays for Development Fees and Exactions? Public Policy Institute of California.

Evans-Cowley, J.S. and L.L. Lawhon. 2003. The Effect of Impact Fees on the Price of Housing and Land: A Literature Review. Journal of Planning Literature 17: 351-359. Abstract only. http://jpl.sagepub.com/content/17/3/351.short

Glaeser, E.L. and J. Gyourko. 2002. The Impact of Zoning on Housing Affordability. National Bureau of Economic Research Working Paper 8835.

Huffman, F.E., A.C. Nelson, M.T. Smith, and M.A. Stegman. Who Bears the Burden of Development Impact Fees? Journal of the American Planning Association 54: 49-55. Abstract only. http://www.tandfonline.com/doi/abs/10.1080/01944368808977152#.Uf_CqtKsiSo

Ihlanfeldt, K.R. 2007. The Effect of Land Use Regulation on Housing and Land Prices. Journal of Urban Economics 61: 420-435.

Langbein, L. and K. Spotswood-Bright. 2004. Efficiency, Accountability, and Private Government: The Impact of Residential Community Associations on Residential Property Values. Social Science Quarterly 85.

Mayer, C.J. and C.T. Somerville. 2000. Land Use Regulation and New Construction.

Oates, W.E. 1969. The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis. Journal of Political Economy.

Pollakowski, H.O. and S.M. Wachter. 1990. The Effects of Land Use Constraints on Housing Prices. Land Economics 66.

Quigley, J.M. and S. Raphael. 2004. Regulation and the High Cost of Housing in California.

Quigley, J.M. and L.A. Rosenthal. 2005. The Effects of Land Use Regulation on the Price of Housing: What Do We Know? What Can We Learn? Cityscape: A Journal of Policy Development and Research 8.

Rafter, D. 2000. The Messy Business of Maintaining BMPs: Who's Responsible for Best Management Practices? Stormwater, The Journal for Surface Water Quality Professionals, September 2007.

Ruppert, T. 2008. From Rooftop to River: Implementing Low-Impact Development Stormwater Management for New Residential Development in Florida.

Shaughnessy, T.M. 2003. Estimation of the Effects of Development Impact Fees on Housing and Land Markets. The Florida State University College of Social Sciences.

Shiller, R.J. 2007. Understanding Recent Trends in House Prices and Home Ownership. National Bureau of Economic Research Working Paper 13553.

Singell, L.D. and J.H. Lillydahl. 1990. An Empirical Examination of the Effect of Impact Fees on the Housing Market. Land Economics 66.

Skaburskis, A. and M. Qadeer. 1992. An Empirical Estimation of the Price Effects of Developmental Impact Fees. Urban Studies 29: 653-667. Abstract only. http://usj.sagepub.com/content/29/5/653.short

Skidmore, M. and M. Peddle. 1998. Do Development Impact Fees Reduce the Rate of Residential Development? Growth and Change 9: 383-400.

Tian, S. 2011. Managing Stormwater Runoff with Green Infrastructure: Exploring Practical Strategies to Overcome Barriers in Citywide Implementation. University of Nebraska – Lincoln Community and Regional Planning Program.

United States Environmental Protection Agency (U.S. EPA). 2013. The Importance of Operation and Maintenance for the Long-Term Success of Green Infrastructure.

United States Environmental Protection Agency (U.S. EPA). 2012. Maintenance of Low Impact Development: Communities are Easily Managing LID Practices.

United States Environmental Protection Agency (U.S. EPA). 2009. Economic Analysis of Final Effluent Limitation Guidelines and Standards for the Construction and Development Industry.